

## 9. PERSONAL PROTECTIVE EQUIPMENT

The OU 3-13, Group 5, SRPA project poses potential hazards to personnel from drilling in contaminated areas and from industrial safety hazards (moving equipment and vehicles). Anyone entering the CRZ and EZ must be protected against these potential hazards. The purpose of PPE is to shield or isolate personnel from chemical, radiological, and physical hazards that cannot be eliminated through engineering or other controls during the project. It is important to realize that no PPE ensemble can protect against all hazards, so safe work practices and adequate training are very important in providing a greater level of protection to workers than PPE alone.

**Note:** For upgrading or downgrading PPE, the FTL and HSO must involve the IH, RCT, and/or the RE before any changes are made.

Selection of the proper PPE to protect personnel is based on the following:

- The project tasks to be conducted (mobilization, etc.)
- Known or suspected radiological and nonradiological materials and agents expected to be found at the project site
- Potential contaminant routes of entry
- Physical form and chemical characteristics of contaminants
- Acute and chronic effects from exposure to contaminants
- Local and systemic toxicity of contaminants
- Anticipated exposure levels (surface and airborne)
- The Hazard Analysis (Section 8) evaluation of this HASP
- Potential contaminant exposure duration.

Anti-contamination requirements are dictated by RWP in conformance with MCP-432.

The PPE is generally divided into two broad categories: (1) respiratory protective equipment, and (2) personal protective clothing. Both of these categories are incorporated into the standard four levels of protection (Levels A, B, C, and D), based on the potential severity of the project hazards. Table 9-1 provides guidance in the selection process for respiratory and protective clothing.

### 9.1 Respiratory Protection

- Several of the radiological and nonradiological contaminants anticipated present a potential respiratory hazard if released in an airborne respirable form. Although the exposure potential for this project is low, Table 9-1 provides general guidelines for respiratory protection and PPE.

**Table 9-1. Respiratory and protective clothing selection.**

Hazard	Level of Protection
<b>Respiratory PPE Selection<sup>a</sup></b>	
Not immediately dangerous to life or health (IDLH) or oxygen deficient atmospheric conditions. Gaseous, vapor, particulate and/or aerosol chemicals/radionuclides.	Level C—full-facepiece, as determined by IH/Radcon Level B—full-facepiece supplied air respirator with an air-purifying escape cartridge or airhood (bubblehood) HEPA/chemical combination cartridge for concentrations up to the protection factor of an air-purifying full-facepiece respirator and within the assigned DAC <sup>b</sup> value
IDLH or oxygen deficient atmospheric conditions.	Level B—full-facepiece, supplied air respirator with an escape-only SCBA <sup>c</sup> or Level A—self-contained breathing apparatus
<b>Protective Clothing Selection</b>	
Low atmospheric contaminant levels that are present under stable conditions. No anticipated immersion, splashes or potential for unexpected contact with chemical or radiological contaminants.	Level D
Moderate atmospheric contaminants under relatively stable conditions, liquid splashes or other direct contact that do not have corrosive characteristics or can be absorbed by exposed skin. Low radionuclide contamination and airborne radioactivity levels. <sup>d</sup>	Level C
a. A multi-chemical/HEPA combination cartridge to be selected by IH and RADCON personnel based on specific task hazards. b. Derived air concentration (DAC) based on specific radionuclides. c. SCBA = self-contained breathing apparatus. d. Contamination levels and airborne radioactivity as defined by 10 CFR 835.603.d.	

All personnel required to wear respirators will complete training and be fit-tested before being assigned a respirator per the training and documentation requirements in Section 4 of this HASP. Requirements for respirator use, emergency use, storage, cleaning, and maintenance, as stated in MCP-2726, "Respiratory Protection," will be followed.

## 9.2 Personal Protective Equipment Levels

The following sections provide detail and explanation of the four levels of PPE. Modifications to these levels will be made under the direction of the HSO in consultation with the project IH and Radcon personnel, as appropriate. Such modifications are routinely employed during HAZWOPER site activities to maximize efficiency and to meet site-specific needs without compromising personnel safety and health. The HSO, IH, and Radcon personnel will determine what modifications are appropriate to the PPE levels listed on Table 9-2.

**Table 9-2. PPE requirements and modifications.**

Task or Assignment	Level of PPE	Modifications and Comments
Mobilization / demobilization	Level D	All mobilization tasks in the SZ will be conducted in Level D PPE with some modification for hand and head protection as warranted. Modification will be per the task RWP for radiological concerns.
Drilling and sampling	Level D—(initially) modified Level D	Upgrading to modified Level D (protective clothing) if contamination is detected above RWP limits during sampling.
	Level C	If atmospheric contaminants increase to concentrations above action limit, Level C air-purifying respirator (APR) protection (chemical/radiological) will be worn in conjunction with chemical protective clothing (Tyvek coveralls or equivalent).
Geophysical logging	Level D—(initially) modified Level D	Upgrading to modified Level D (protective clothing) if contamination is detected above RWP limits during logging activities.
Well and instrumentation installation	Level D or as described in the RWP	All installation tasks will be conducted in Level D PPE with some modification for hand and head protection as warranted. Modification will be per the task RWP for radiological concerns.
Moisture potential measurements and water sampling	Level D or as described in the RWP	If sampling release contaminants to the atmosphere above action levels, or if splashing occurs, Level C APR protection (chemical/radiological) will be worn in conjunction with chemical protective clothing (Tyvek coveralls or equivalent).
Decontamination within the EZ	Level C	All decontamination will be conducted in Level C, double Anti-C (outer layer may be coated Tyvek or Saranex-23C if contact with waste residue cannot be eliminated), all seams taped, and other requirements per the task/area RWP.
Decontamination outside EZ	Modified Level D	General decontamination of uncontaminated surfaces (general washing) in the SZ or other designated area will be conducted in modified Level D if a high-pressure sprayer or steam cleaner is used to prevent splashing and spraying hazards (face shield, apron, rubber boots) will be worn.

### 9.2.1 Level D Personal Protective Equipment

Level D PPE will only be selected as a work uniform and is not appropriate on a site with respiratory or skin absorption hazards requiring whole body protection. It provides no protection against airborne chemical hazards, but rather is used for protection against nuisance contamination and physical hazards. Level D PPE will only be allowed in areas that have been characterized or are known to have not been contaminated.

**Note:** *Personnel must inspect all PPE before donning and entry into any work zone. Items found defective or unserviceable during use will be doffed, disposed in accordance with posted procedures, and placed into the appropriate waste stream. The PPE inspection guidance is provided in Section 9.4.*

Level D PPE is the anticipated level of protection for most of the activities conducted during this project. However, the Level D PPE ensemble may be modified by the HSO, IH, and/or RCT to provide protection from skin and physical hazards, but not respiratory protection. Basic Level D PPE consists of the following:

- Coveralls or work clothes (as determined by the IH and/or RCT)
- Hard hat (as required by SE and type of work being performed)
- Eye protection, safety glasses with side shields as a minimum (see MCP-2716)
- Safety footwear (steel or protective toe and shank, as determined by the SE).

Optional Level D modifications consist of the following:

- Chemical or radiological protective clothing (Tyvek, Saranex, etc.) as prescribed in site-specific RWP or SWP
- Chemically resistant hand and foot protection (inner/outer gloves, boot liners, etc.)
- Radiological modesty garments under outer protective clothing
- Any specialized protective equipment (hearing protection, cryogenic gloves, face shields, welding goggles, aprons, etc.).

### 9.2.2 Level C Personal Protective Equipment

Level C PPE will be worn when chemical and/or radiological contaminants have been well characterized indicating personnel are protected from airborne exposures by wearing air-purifying respirators with the appropriate cartridges. Conditions excluding the use of air purifying respirators

include oxygen-deficient environments (oxygen <19.5% at sea level), and IDLH atmospheres. Basic Level C PPE will include

- Level D ensemble with the following respiratory and whole body protection upgrades:
  - Full-facepiece APR equipped with a NIOSH approved HEPA/chemical combination cartridge (IH to specify chemical combination cartridge)
  - Chemical-resistant coveralls (Tyvek QC®, Tychem 7500®, Saranex-23-PTM, etc.) as prescribed in site-specific RWP or SWP (IH to specify material)
  - Chemical-resistant outer shoe/boot cover (IH and/or RCT to specify material)
  - Inner chemical-resistant nitrile rubber gloves with cotton liners (as determined by the IH and/or RCT)
  - Outer chemical-resistant Viton or polyvinyl alcohol (PVA) gloves (as determined by the IH)
- Optional Level C modifications:
  - Radiological modesty garments under outer protective clothing
  - Any specialized protective equipment (hearing protection, welding lens, aprons, etc.).

### **9.3 Protective Clothing Upgrading and Downgrading**

The OU 3-13, Group 5, SRPA project HSO, in consultation with the project IH and Radcon personnel, will be responsible for determining when to upgrade or downgrade PPE requirements. Upgrading or downgrading of PPE requirements based on current conditions is a normal occurrence. Action levels, listed in Section 8 or as provided in the RWP, are the basis for determining such decisions. Additional reasons for upgrading or downgrading include

- Upgrading criteria (work will stop immediately if PPE upgrading is required)
  - Unstable or unpredictable site radiological and/or nonradiological hazards
  - Contaminants that present difficulty in monitoring or detecting
  - Known or suspected presence of skin absorption hazards
  - Temporary loss or failure of any engineering controls
  - Identified source or potential source of respiratory hazard(s)
  - Change in the task procedure that may result in an increased contact with contaminants or meeting any of the criteria listed above.

- Downgrading criteria

**Note:** *A new RWP must be issued when PPE is downgraded on the basis of radiological exposures.*

- New information of monitoring data that shows the contaminant levels to be lower than established action limits
- Implementation of new engineering or administrative controls that eliminate or significantly mitigate hazards
- Elimination of potential skin absorption or contact hazards
- Change in site conditions that results in removal of physical hazards or reduces/isolates them to a controlled area
- Completion or change in tasks that results in the elimination of key hazards that requires higher levels of PPE.

## **9.4 Inspection of PPE**

All PPE ensemble components must be inspected prior to use. When in use it must be within the project work zones. Self-inspection and the use of the buddy system, once PPE is donned, will serve as the principal forms of inspection. If at any time, PPE should become damaged or degradation/permeation is suspected, an individual will inform others of the problem and proceed directly to the work zone exit point to doff and replace the unserviceable equipment. Additionally, all PPE that becomes grossly contaminated or presents a potential source for the spread of such contamination will be decontaminated or replaced. Table 9-3 provides an inspection checklist for common PPE items.

**Table 9-3. PPE inspection checklist.**

PPE Item	Inspection
Gloves	<p>Before use:</p> <ul style="list-style-type: none"><li>• Pressurize gloves to check for pinholes: blow in the glove, swoop glove through air, then roll until air is trapped, and inspect. No air should escape.</li></ul>
Respirators (full-facepiece air-purifying and supplied-air respirators with escape-only SCBA bottles or escape cartridges)	<p>Before use:</p> <ul style="list-style-type: none"><li>• Airline matches the airline respirator to be used (black hose).</li><li>• Inspect airline hose connections (sections of hose) to ensure all are threaded or permanent metal-to-metal connections (no quick disconnect pieces).</li><li>• Check condition of the facepiece, head straps, valves, connecting lines, fittings, all connections for tightness.</li><li>• Check cartridge to ensure proper type/combination for atmospheric hazards to be encountered; inspect threads and O-rings for pliability, deterioration, and distortion.</li><li>• Check for proper setting and operation of regulators and valves, check all hose connections back to the breathing air compressor; check the pressure to the airline station, and on individual airline connections to ensure pressure is within required range (in accordance with the manufacturer's specification).</li></ul>
Level D and C clothing	<p>Before use:</p> <ul style="list-style-type: none"><li>• Visually inspect for imperfect seams, nonuniform coatings, tears, etc. Hold PPE up to the light and inspect for pinholes, deterioration, stiffness, and cracks.</li></ul> <p>While wearing in the work zone:</p> <ul style="list-style-type: none"><li>• Evidence of chemical attack, such as discoloration, swelling, softening and material degradation. Inspect for tears, punctures, and zipper or seam damage. Check all taped areas to ensure they are still intact.</li></ul>

## **10. DECONTAMINATION PROCEDURES**

Every effort will be made to prevent contamination of personnel and equipment through the use of engineering controls, isolation of source materials, continuous site monitoring and surveying, personnel contamination control training, and by following all contaminated material handling requirements and procedures.

### **10.1 Contamination Control and Prevention**

Everything that enters the established contamination area has the potential of becoming contaminated. Contamination control and prevention procedures will be implemented throughout the project to minimize personnel contact with contaminated surfaces. For this project the following contamination control and prevention measures will be employed:

- Identify potential sources of contamination and design containment, isolation, and engineering controls to eliminate or mitigate any potential for contact or release of contaminants
- Limit the number of personnel, equipment, and materials that enter the contaminated area
- Decontaminate immediately any surfaces where contamination is found on the equipment, (see Section 10.2.3)
- Use only the established control entry and exit point from the contaminated area to minimize the potential for cross-contamination and expedite contamination control surveys
- Wear disposable outer garments and utilizing disposable equipment (where possible).

### **10.2 Personnel and Equipment Decontamination**

Decontamination procedures for personnel and equipment are necessary to control contamination and protect personnel. Both chemical and rationalized contamination will be decontaminated from surfaces at the exit from the contaminated area and other work zone transition boundaries (CRZ for nonradiological nonhazardous materials, as appropriate).

All rationalized decontamination operations for equipment and areas will be performed in accordance with Chapter 4 of the INEEL *Radiation Protection Manual*, 15A. Nonradionuclide decontamination will be evaluated on a case-by-case basis by the HSO and project IH to determine the most appropriate PPE (Level C protective clothing will initially be selected until site monitoring can demonstrate downgrading is warranted). It is not expected that nonradionuclide contamination will be present without some detectable radionuclide contaminants. Specific personnel and equipment decontamination methods are provided below.

#### **10.2.1 Personnel Decontamination**

Engineering controls, in conjunction with project contamination prevention and control practices and proper protective clothing donning and doffing procedures, will serve as the primary means to eliminate the need for personnel decontamination. Procedures for donning and doffing protective clothing will be posted at the entrance and exit to all radionuclide contamination areas established. Prior



to donning PPE, all items will be inspected following the list in Table 9-3. Following the donning of protective clothing, your buddy, the FTL, HSO, and/or RCT will check to verify proper donning technique. If personnel do become contaminated, based upon the contaminant, the IH and RCT will determine appropriate method for decontamination.

### **10.2.2 Decontamination in Medical Emergencies**

If a person is injured or becomes ill, they will immediately be evaluated by first-aid-trained personnel at the task location. If serious, then the FTL or HSO will contact the Warning Communications Center (WCC) to summon emergency services (FD and CFA Medical) to the site. In addition, the JSS and others will be contacted, as stated in Section 11.

Medical care for serious injury or illness will not be delayed for decontamination. In such cases, gross contamination may be conducted by removing the injured person's outer protective clothing (if possible) and other contaminated areas contained with a bag, glove, etc. If contaminated PPE cannot be removed without causing further injury (except for the respirator, which must be removed), the individual will be wrapped in plastic, blankets, or available material to help prevent contaminating the inside of the ambulance, medical equipment, and medical personnel. The IH and/or RCT (depending on the type of contamination) will accompany the employee to the medical facility to provide information and decontamination assistance to medical personnel. Contaminated PPE will then be removed at the CFA medical facility and carefully handled to prevent the spread of contamination. The INEEL *Radiation Protection Manual*, 15A, Chapter 5, and MCP-148, "Personnel Decontamination," contains information on proper handling of radionuclide-contaminated wounds.

### **10.2.3 Equipment Decontamination**

Containment engineering and isolation controls have been designed to prevent contamination from project waste. These engineering controls will serve to isolate and eliminate or mitigate many of the potential contamination pathways to prevent equipment contamination and greatly reduce the need for decontamination. Project IH and RadCon personnel will conduct surveys and collect swipes throughout the core sampling and abandonment tasks in accordance with the technical procedures (TPRs) to evaluate engineering controls, material-handling methods, and containment integrity.

Both real-time instrumentation and visual observation will be used to detect contamination within and beyond the (the work area to be described in the work order, RWP, and/or SWP). Instrumentation and visual methods will be utilized for both equipment and personnel to determine contamination detection and minimize the potential spread and airborne generation of contaminants. Where radiological and IH concerns do not prohibit their use, SOP-11.4, "Field Decontamination of Heavy Equipment, Drill Rigs, and Drilling Equipment," and SOP-11.5, "Field Decontamination of Sampling Equipment," will be followed. The RadCon and IH personnel will evaluate any contaminated equipment to determine the most appropriate decontamination method based on the nature of the contaminated item, level of contamination, required effort to decontaminate the item, and requirement for decontaminating versus disposing such items. In some cases, the level of effort and potential for spreading contamination from conducting decontamination tasks far outweigh the benefit from engaging in extensive decontamination efforts to return an item to service. A cost-ALARA versus benefit evaluation will be done on items that have extensive contamination or are relatively inexpensive. Low-cost consumable items will be discarded if initial decontamination efforts fail or extensive decontamination is required that is not in accordance with ALARA principles.

For nonradionuclide decontamination of free-released equipment, a decontamination pad may be established in the CRC. If it is deemed necessary and appropriate by the project IH, then a wet wiping

steam cleaning of this equipment prior to leaving the CRC may be conducted. If steam cleaning is performed, a drainage system that allows for a single collection point will be established. Decontamination wastewater will be collected using a pump and containerized/characterized in accordance with the Company Manual 8, *Environmental Protection and Compliance*.

## **10.3 Disposal of Contaminated PPE and Equipment**

### **10.3.1 Storage and Disposal of Contaminated Materials**

All PPE and other disposal material directly used in sampling, such as decontamination, will be treated using the methods recommended by Waste Generator Services (WGS). Specific guidance for disposal of project waste, including PPE and equipment, is outlined in the OU 3-13, Group 5 Characterization Plan.

### **10.3.2 Project Sanitation and Waste Minimization**

Portable toilet facilities shall be provided inside the project administrative area. Potable water and soap will also be available at the site for personnel to wash their hands and face upon exiting the area. It is important to note that any required radionuclide contamination surveys must be performed before washing face and hands to prevent accidental spread of contamination.

Waste materials will not be allowed to accumulate at the project. Appropriate containers for contaminated and noncontaminated waste will be maintained at step-off areas, in the SZ, and at other appropriate locations at the project. All waste will be surveyed by the RCT before removal from the project. Personnel should make every attempt to minimize waste through judicious use of consumable materials. All project personnel are expected to make good housekeeping a priority at the project.